SEX WORK

Estimation of the sexual transmission of HIV in Kenya and Uganda on the trans-Africa highway: the continuing role for prevention in high risk groups

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Objective: To explore the effect of transactional sex on the trans-Africa highway from Mombasa-Kampala in contributing to the HIV epidemic and the impact that an effective prevention intervention could have.

Methods: Variables for input into a simple model of HIV prevention, AVERT, were derived from a study of hot spots of transactional sex on the trans-Africa highway. Diaries were completed by a sample of sex workers at selected sites of transactional sex for a period of 28 consecutive days. Key information elicited included numbers, types and occupations of clients, numbers of liaisons, sexual acts in each liaison, and condom use. 857 diaries were distributed and 578 received and usable in 30 sites. A sexual patterning matrix was completed by 202 truckers at the Malaba border point as part of a health seeking behaviour survey. Two methods were employed to estimate female sex worker (FSW) numbers on the highway. FSW focus group discussions (FGDs) at 15 sites were carried out and included questioning on the number of sex workers at the site. As most transactional sex on the highway is centred on bars and lodgings, a patron census and survey of 1007 bars and lodgings was carried out which included questions on the presence and proportions of FSWs among the clientele.

Results: There are an estimated 8000 FSWs on the trans-Africa highway from Mombasa to Kampala. Annual numbers of different sexual partners per FSW were 129, annual numbers of sexual acts per FSW were 634, percentage of sexual acts protected by condom use was 77.7%. Using these input data an estimated 3200–4148 new HIV infections occur on this portion of the trans-Africa highway in 1 year. Having a 90% condom use programme in place could prevent almost two thirds of these infections and cumulative incidence would decline from 1.29% to 0.42%.

Conclusions: In generalised epidemics there has been a debate as to the place of targeted interventions. In the current east African epidemic we show that a targeted intervention could have significant impact in averting HIV infections related to the trans-Africa highway.

It has been well documented that transport workers and truck drivers in east Africa and Kenya are at much higher risk for HIV than the general population. For example, a survey at Athi River in Kenya of 970 drivers and assistants at a roadside clinic showed 27% HIV prevalence, while a study at Mariakani, Kenya, in 1995 of 283 drivers and assistants showed a similar result of 26% prevalence.^{1,2}

Other populations along the roadside, such as female adolescents, have been the subject of study and have been shown to be at risk as a result of proximity to the highway. A study in 1997 of 200 adolescents aged 15–19 years of age at truck stops in Kenya showed that 46% engaged in sex with transport workers, 78% of the females had traded sex for gifts or money, and 52% had experienced a sexually transmitted disease.³

Other academic studies have outlined the need and utility of targeting these populations. A study in Mombasa of an intervention including condom promotion, peer education, and access to high quality sexually transmitted infection care in 556 male transport workers showed clear evidence of decreased high risk sexual behaviour and decreased sexually transmitted infections.⁴

Given this background it is surprising that no coordinated programme has addressed either transport workers or sex workers in east Africa. The focus of the programmes in the region has been on responding to a generalised HIV epidemic and so these populations have been neglected. This is unfortunate as evidence suggests that they account for a

disproportionate number of infections even in this generalised epidemic.⁵

Given the lack of targeted response in the region we sought to define the number of HIV infections attributable to the Mombasa-Kampala section of the trans-Africa highway and estimate the potential impact of a targeted programme.⁶

METHODS

We used a simple model of HIV prevention, AVERT, to estimate the number of new primary HIV infections attributable and those that could be averted with a 90% condom program applied to the trans-Africa highway from Mombasa-Kampala. This model is simple to use given inputs from programme data and measures primary HIV infections only.⁷ The input variables for the model were derived from the study of hot spots of transactional sex on the trans-Africa highway or where these values were not available either recent national behavioural surveys or published scientific literature was used.

A sex worker diary was used to quantify condom use with clients at 30 major sites of transactional sex on the trans-Africa highway.⁸ Snowballing of the FSWs at each highway site was used for recruitment of participants to complete a sex work diary. The diaries were designed to run for a consecutive 28 day period so as to encompass both a

Abbreviations: FSW, female sex worker; FGDs, focus group discussions

Table 1 Model parameters

Parameter	Value
Highway based FSW population	8000
Annual numbers of different sexual partners per FSW	129
Annual numbers of sexual acts per FSW	634
Percentage sexual acts protected by condom use from diaries	77.7%
Sexually transmitted infections in past year	20%
Annual number of partners of transport workers	2.8
(p) Male>female	0.002
(p) Female>male	0.001
Condom effectiveness	0.95

biological month and a business month and negate significant temporal variation. To ensure quality control volunteers were guided through the completion process of the diaries and, when possible, participants were asked to return within a few days after commencing recording to have the recording checked. At the collection day, individual diaries were checked and corrections made. Diaries were checked for completeness, authenticity, and obvious error at each site by researchers. Variables recorded by sex workers included daily client number, occupation, condom use per sex act, number of daily liaisons, sex acts, and self determined classification of the client into regular or casual.⁹ The diary data were used to input annual number of sexual partners for each sex worker, number of liaisons annually, and condom use.

A sexual patterning survey was completed involving 202 truckers interviewed at the Kenya-Uganda border point as part of a larger health seeking behaviour survey. Partner numbers and types and condom use levels were derived from this survey.

Two methods were employed to estimate female sex worker (FSW) numbers on the highway. FSW focus group discussions (FGDs) at 15 sites were carried out and included questioning on the number of sex workers at the site. As most transactional sex on the highway is centred on bars and lodgings a survey of 1007 bars and lodgings was carried out which included questions on the presence and proportions of FSWs among the clientele. Male and female bar patrons were counted hourly in the evenings over seven consecutive days in every bar. Estimations of percentage sex worker number were made by bar managers and applied to actual counts.

HIV prevalence in sex workers was estimated from national surveillance and behavioural survey data in Kenya and Uganda in these high risk groups.^{10 11} HIV prevalence in transport workers was estimated from surveys in transport workers in the region.^{1 2 12}

A value for HIV prevalence of 50% was used as the default value for sex worker prevalence as this was the value obtained in the only population based sample in the region.¹⁰ For transport workers the default value used was 20% based on extrapolation from published studies and unpublished work in the region.

Probabilities and estimations were derived from the AVERT model of HIV transmission-prevention (see table 1).

The mathematical foundation underlying the AVERT model is a derivation of a probability formula presented by Weinstein *et al*¹³:

$$P = 1 - \left\{ p \sum_{i=1}^4 w_i [1 - r_{gi} (1 - fe)]^n + (1 - p) \right\}^m$$

The first sequence of calculations yields a probability of risk to the target population (population A)

This result is multiplied by the number of susceptible individuals in B, generating an estimate of new infections within this group.

$$P_{A \leftarrow B} = 1 - \left\{ p_B \sum_{i=1}^4 w_i [1 - r_{A \leftarrow Bi} (1 - fe)]^{n_A} + (1 - p_B) \right\}^{m_A}$$

Once cumulative probabilities are calculated for each study population (*PAB* and *PBA*), those values are multiplied by the corresponding HIV negative populations. These procedures produce estimates of new HIV infections within each group, and the total comprises the estimate for the target and partner populations combined.

$$P_{B \leftarrow A} = 1 - \left\{ p_A \sum_{i=1}^4 w_i [1 - r_{B \leftarrow Ai} (1 - fe)]^{n_B} + (1 - p_A) \right\}^{m_B}$$

where *p* is the HIV prevalence, *m* is the average number of sexual partners, *n* is the average number of sexual acts with each individual, *f* is condom use, *e* is condom efficacy, *wi* is the prevalence of STDs, and *rgi* is HIV transmissibility.

To ascertain how robust the estimates were using the model sensitivity analysis was done on the estimates of HIV prevalence in clients and sex workers on the highway.

RESULTS

FSW numbers were triangulated from estimates at each site of transactional sex through FSW FGDs and bar patron counts and estimates given by bar lodging staff. The two methods gave similar numbers with there being approximately 8000 FSWs at 47 sites where transport workers stopped between Mombasa and Kampala. This estimate does not include urban centres along the highway, as truckers tend to avoid large towns as stopover points.

From 578 diaries completed in 30 sites the FSWs recorded a total 14 072 separate liaisons during the 28 day period. The remaining diaries were either not completed or they were not returned and therefore lost to follow up. The mean annual number of different partners per FSW was 129. Each sex worker recorded the number of coital acts with each client and the annual mean, extrapolated from the monthly averages, was 634 acts per sex worker. At each liaison, the use or non-use of a condom was recorded. Overall, 77.7% of liaisons were protected with a condom. In liaisons where condoms were used, the numbers of coital acts corresponded with the numbers of condoms used 80% of the time, with 6% of liaisons recording fewer numbers of condoms used than coital acts. The remaining 14% recorded more condoms used than sexual acts taking place.

Of 202 responses from a survey of truckers at the Kenya-Uganda border, the mean number of partners in the past year was 2.8.

The HIV prevalence in the FSW population was assumed to be 50% from the largest recent behavioural survey.⁸ Sensitivity analysis was carried out with prevalence of 30% and 40% based on other more limited surveys in these countries.⁸

Sexually transmitted infections in the past year in FSWs was taken from other recent surveys of FSWs in the country and a value of 20% was used.¹⁴

The prevalence of HIV in transport workers was 20% and sensitivity analysis was done at 15 and 25% based on recent and past serosurveys.^{1-3 15}

The parameters used in the model are described in table 1.

The values in table 1 were included in the model with a sensitivity analysis done for the prevalence of HIV in sex workers and their clients on the highway.

Table 2 Estimation of primary HIV infections and incidence rates at current (78%) levels of condom use and at 90% use with varying levels of HIV prevalence in FSWs (transport worker/client prevalence 20%)

	Primary HIV infections at current condom use	HIV incidence at current condom use (%)	Primary HIV infections at 90% condom use	HIV incidence at 90% condom use (%)	HIV infections averted	Total primary HIV infections averted	Decline in number of new primary infections (%)
FSW 40%	1064	22.17	412	8.58	652		
Transport workers/clients	2610	0.89	885	0.30	1780	2377	64.7
FSW 50%	887	22.18	343	8.58	544		
Transport workers/clients	3260	1.11	1106	0.38	2154	2698	65.06
FSW 30%	1241	22.16	306	8.57	761		
Transport workers/clients	1959	0.66	1599	0.23	1295	2056	64.25

Table 3 Estimation of primary HIV infections and incidence rates at current (78%) levels of condom use and at 90% use with varying levels of HIV prevalence in transport workers (FSW prevalence 50%)

	Primary HIV infections at current condom use	HIV incidence at current condom use (%)	Primary HIV infections at 90% condom use	HIV incidence at 90% condom use (%)	HIV infections averted	Total primary HIV infections averted	Decline in number of new primary infections (%)
Transport workers/client prevalence 15%	3463	1.11	1175	0.38	2288		
FSW	685	17.13	260	6.50	425	2713	65.41
Transport workers/client prevalence 25%	3056	1.11	1037	0.38	2019		
FSW	1076	26.90	424	10.6	652	2671	64.64

Using HIV prevalence of 30–50% for sex workers and 15–25% for clients there were 3200–4148 new primary infections on the highway in 1 year. When condom use was modelled to increase to 90% between 2056–2713 HIV infections could be averted on the highway. This represents a 64.70%–65.06% decline over 1 year with 90% condom use (tables 2 and 3).

DISCUSSION

Mobile populations have long been regarded as vulnerable to HIV infection.^{1,2} The core interventions that are needed are well described but have not been systematically implemented in eastern Africa. These interventions include peer education, condom promotion, and access to STI services.⁴

We found that condom use among FSWs on the trans-Africa highway was higher than was seen in recent behavioural survey of the general population, but that a significant number of new HIV infections occur on traditional high risk transport routes, as no targeted interventions have been employed in either Kenya or Uganda.^{10,11} The finding that a standard prevention programme that increased condom use to 90% would avert two thirds of the new infections is important in the context of the declining epidemic in east Africa and the continued role of core transmitter groups in fuelling the epidemic.

These findings are consistent with some recent literature on the place of targeted interventions in generalised HIV epidemics.¹³

Limitations of the current study include selection bias in the recruitment of sex workers to fill in the diary, which required basic literacy. In addition, the model only calculates primary infections and given the dynamics of HIV infection this underestimates the contribution of this group which has multiple and serial partners. Other limitations include the limited geographic scope of the study, which describes one major truck route in the region, although it is the busiest and most important.

This study outlines the continued importance of core and bridge populations in the HIV epidemic in Africa and highlights the need for targeted prevention interventions in the HIV epidemic in east Africa.

CONTRIBUTORS

CNM designed the study, participated in data analysis, data collection, and wrote the submission; AGF participated in data analysis, editing the submission, and data collection.

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